



Original Communication

Firearm-related deaths in Brescia (Northern Italy) between 1994 and 2006: A retrospective study

Andrea Verzeletti MD *, Paolo Astorri MD, Francesco De Ferrari MD (Professor)

Istituto di Medicina Legale, Università degli Studi di Brescia, Piazzale Spedali Civili 1, 25123 Brescia, Italy

ARTICLE INFO

Article history:

Received 5 July 2008

Received in revised form 12 December 2008

Accepted 12 January 2009

Available online 13 February 2009

Keywords:

Firearm-related deaths

Homicide

Suicide

Accidental death

Northern Italy

ABSTRACT

This retrospective study analyzes post-mortem examination data of 164 firearm-related casualties recorded by the Brescia, Italy Institute of Forensic Medicine between the years 1994 and 2006. The following variables were considered: year, month and day of death, gender and age of the victim, manner of death (homicide, suicide, accidental), type of weapon used, anatomical site and number of wounds, scene of death, and, whenever requested by the local District Attorney's Office, results of the toxicological examinations conducted on the corpses of the deceased.

In the County of Brescia, Italy, the 2006 firearm-related mortality rate amounted to 0.84 per 100,000 residents, with an average of 12.6 cases per year. The most common manner of death was suicide (60.4%), followed by homicide (35.9%) and accidental death (3.7%). Most victims were male, with an average age of 47.2 in cases of suicide, 37.9 in cases of homicide, and 47.5 in cases of accidental death. Considering all of the death manners contemplated in this study, the weapon types most frequently resorted to were single-action, short-barrelled guns, followed by multiple-action, long-barrelled ones. In cases of suicide, entry wounds were primarily situated on the head (right temple) and chest (precordium), while in cases of homicide no conclusions could be drawn as to the entry wounds' predominant location.

© 2009 Elsevier Ltd and Faculty of Forensic and Legal Medicine. All rights reserved.

1. Introduction

Every year in the world, hundreds of thousands of people lose their lives due to injuries caused by firearms.¹ In different countries, the prevalence of this cause of death may vary greatly based on differences among local regulatory approaches.^{2–4}

For a Canadian resident, for instance, the risk of dying from firearm-related injuries equals that of dying as a result of being involved in a road traffic accidents;⁵ in the United States, the relative risk of death by firearm versus death by RTA is even higher.^{6–9}

In European countries, on the other hand, firearm deaths are undoubtedly a less frequent occurrence. In Sweden, for example, the mortality rate due to firearm injury is about 200 per year, and mainly subsequent to suicides,¹⁰ the same being true for Finland¹¹ or Denmark;¹² whereas in England and Wales firearm deaths are even less common.^{13,14}

In Italy, the risk of dying from gunshot wounds varies from Region to Region, with Puglia, Campania, Calabria and Sicily (Southern Italy) being associated with the highest risk.^{15,16}

The purpose of this study is to investigate a number of characteristics of gunshot deaths as recorded by the Brescia, Italy Institute of Forensic Medicine between 1994 and 2006, and to

compare the resulting statistical patterns with those emerging in other nations.

During the time span taken as a reference, the population of the area falling within the purview of the Brescia Institute of Forensic Medicine amounted to approximately 1.5 million (2.6% of the overall population of the Republic of Italy).

2. Materials and methods

Over the period comprised between January 1, 1994 and December 31, 2006, 5686 post-mortem investigations (4495 autopsies and 1191 external examinations) were conducted by the Brescia Institute of Forensic Medicine, leading to the identification of 164 firearm-related casualties (150 cases autopsied; 14 cases subjected to external examination), which accounted for 2.9% of all post-mortem examinations. Explosion casualties are not contemplated in this study.

In each case, the following data were recorded:

- (I) day, month and year of death;
- (II) type of post-mortem examination (autopsy or external examination);
- (III) gender;
- (IV) age;
- (V) manner of death (suicide, homicide, accident);

* Corresponding author. Tel.: +39 030 399 5838; fax: +39 030 399 5839.
E-mail address: verzelet@med.unibs.it (A. Verzeletti).

- (VI) type of firearm involved (gun, rifle, shotgun, other);
- (VII) weapon action (single or multiple);
- (VIII) number of gunshot wounds;
- (IX) site of entry wounds;
- (X) accident scene information / crime scene information;
- (XI) toxicological exam outcomes (whenever mandated by the Law).

The sites of entry of the projectiles were also analyzed by organizing a human model consisting of 20 superficial anatomy areas, in accordance to an approach adopted by several previous studies on this subject.¹⁷ Thus, the head was divided into seven areas [mouth (1), right face (2), left face (3), forehead (4), left temple (5), right temple (6) and back of the head (7)], and the chest into three areas [right anterior chest (8), left anterior chest (9) and precordium (10)]. The other sites were: the neck (11), the nape (12), the abdomen (13), the right posterior chest (14), the left posterior chest (15), the right lumbar area (16), the left lumbar area (17), the genitals (18), and, finally, the superior (19) and inferior (20) limbs (Fig. 1).

3. Results

3.1. Demographic data

Casualties (164) were identified as being firearm-related, accounting for 2.9% of the 5686 post-mortem examinations conducted by the Brescia Institute of Forensic Medicine over the 13 year period taken as a reference. The mortality rate due to firearm wounds amounted to approximately 0.84 per 100,000.

The annual incidence of firearm fatalities in Brescia County showed a steady increase ever since 1994 (3 cases), reaching its peak between 1998 and 2002 (18 cases per year).

On average, most acts of suicide took place in winter and spring, especially in the month of March (14 cases), with only one case occurring in summer (August). As to homicides, no specific monthly predominance patterns emerged.

3.2. Manners of death

As for the manners of death, 59 cases (35.9%) were homicides, 99 (60.4%) suicides, and only 6 (3.7%) could be classified as accidents. Of all homicide victims, 43 (72.9%) were males and 16 (27.1%) were females, whereas in the suicide group 92 (92.9%) were males and only 7 (7.1%) were females; all accident victims (100%) were males.

3.3. Gender and age of victims

Among those dying as a consequence of wounds inflicted by means of a firearm, 86% were males, while only 23 (14%) were females (Table 1). The mean age of homicide victims was 37.9 years, with most cases falling into the 21-to-50 year age range. By contrast, the mean age of suicide victims was 47.2 years, with most victims aged between 21 and 70 years. As for the deaths categorized as accidental, the mean age of the victim was 47.5 years; interestingly, all of these cases were hunting accidents, except for one, which occurred during a brawl.

3.4. Scene of death

The majority of deaths, both homicidal and suicidal in nature, occurred in private homes (53.3%), while 27.1% of homicides occurred on an open-air scene and 17.8% of suicides took place in the passenger compartment of a motor vehicle.

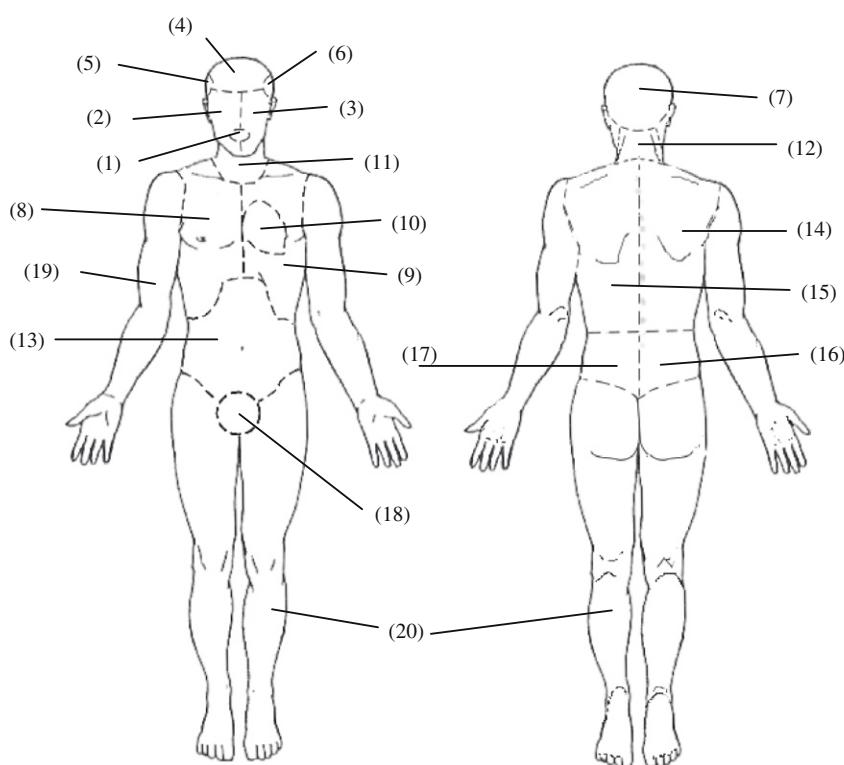


Fig. 1. Distribution of entry wounds: (1) mouth; (2) right face; (3) left face; (4) forehead; (5) right temple; (6) left temple; (7) Back of head; (8) right anterior chest; (9) left anterior chest; (10) Precordium; (11) neck; (12) nape; (13) abdomen; (14) right posterior chest; (15) left posterior chest; (16) right lumbar; (17) left lumbar; (18) genitals; (19) upper limbs; (20) lower limbs.

Table 1

Classification of victims by manner of death and age (M: male; F: female).

		Age (years)									Total
		0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	
Suicide	M	1	3	17	15	13	16	15	7	5	92
	F	–	1	3	–	3	–	–	–	–	7
Homicide	M	–	3	13	10	10	2	4	1	–	43
	F	–	2	5	3	2	1	2	1	–	16
Accidental	M	–	–	–	2	2	–	2	–	–	6
	F	–	–	–	–	–	–	–	–	–	–
Total		1	9	38	30	30	19	23	9	5	164

Table 2

Firearm types.

	Suicides	Homicides	Accidentals
Humane killer	1	1	0
Handgun	58	49	2
Shotgun	39	9	3
Rifle	1	0	1

3.5. Types of firearms

For the sake of simplicity, firearms were grouped into handguns, shotguns and rifles; in only one case (1.2%) a humane killer was used. While the use of single-action weapons accounted for 68.3% of deaths, multiple-action guns only played a role in 30.5% of cases. Most of the cases at issue involved the use of short-barrelled weapons (in essence: pistols or revolvers of different calibres), whereas long-barrelled ones (essentially multiple cartridge hunting rifles) only played a role in 40.2% of suicides and 15.8% of homicides (Table 2).

3.6. Sites of injury and numbers of gunshots

Examination of the 164 corpses at issue revealed the presence of a total of 246 entry wounds.

Based on their general topographical distribution, most injuries occurred on the victim's head (38.6%), followed by the chest (29.3%), the neck (13.4%), the abdomen (9.3%) and the limbs (9.3%).

Interestingly, most corpses of homicide victims presented isolated head wounds, whereas others revealed either a combination of head wounds and other sites of entry, or entry wound sites/combines thereof not including any anatomical region of the head: head/chest and abdomen/limbs (12.1% each); chest/abdomen (9.1%); head/neck/chest, neck/chest, chest, chest/abdomen, abdomen (6.1% each); head/abdomen/limbs, head/neck, head/chest/abdomen, head/chest/limbs, neck/abdomen, neck/chest/limbs/abdomen, neck/chest/limbs and chest/abdomen/limbs (3% each) (see Fig. 2).

As for the cases of self-inflicted death, the right temple (31 cases; 34.4%), the precordium (18 cases; 20%), the neck (15 cases; 16.7%) and the mouth (7 cases; 7.8%) were the anatomical sites most commonly involved (see Fig. 3), whereas in accidental deaths it was the precordium (see Fig. 4).

Of the total number of deaths by firearm analyzed in this study, only 25.2% were determined by multiple wounds, more commonly so in homicides (57.9%) than in suicides (6%).

Aside from two homicide victims shot with 13 and 11 bullets respectively, and another case of homicide involving the projection of both multiple and single bullets, all 164 corpses subjected to forensic examination presented only a small number of gunshot wounds.

3.7. Laboratory findings

In 65 of the cases at hand, toxicological screenings were conducted pursuant to an order by the District Attorney's Office. According to these, 35% of the deceased were under the influence of alcohol, opiates, cocaine, cannabinoids or amphetamines at the time of their death (Table 3). The substances or combinations thereof most commonly detected were either alcohol alone (15 out of 19 positives), or the same combined with cocaine, cannabis, or MDMA. In nearly all cases in which the toxicological examination results came back positive, the victim happened to be a male (91%) aged 21–50 (85%).

4. Discussion

4.1. Firearm-related deaths in the County of Brescia (Northern Italy)

A comparison was drawn between the data emerging from the present study and those resulting from a previous one by Birbes et al. (Brescia, Italy Institute of Forensic Medicine), who, in turn, had focused their attention on the 1983–1993 period¹⁷ (Table 4).

As a result of this comparison, statistically significant coherence was found between the overall incidence of deadly firearm-related injuries within the abovementioned time span (2.5%) and the one emerging from the data currently at hand (2.8%).

If their study, Birbes et al. had highlighted a slight predominance of homicides (50%) compared to suicides (41.7%); during the 1994–2006 period, instead, firearm suicide death rates saw a notable increase (60.4%).

No significant differences were found in reference to the gender of the victims (86% were males, compared to 87.6% in the previous study).

In both studies, the age of homicide victims typically fell within the 21-to-30 year range; as for suicides, the study by Birbes et al. identified the 41-to-50 year age range as the demographical epicentre for suicidal deaths, while no prevalent suicide age group could be isolated in reference to the 1994–2006 timeframe.

No significant cross-study differences emerged as to the monthly distribution of the recorded deaths; according to both the previous and the current studies, suicides appear to have been less frequent during the summer months, while no pattern could be identified as to the monthly or seasonal predominance of homicidal deaths.

Single-action weapons were the most commonly used to inflict or self-inflict deadly wounds (68.3% according to the present study, 68.7% according to the previous one).

According to both studies, entry wounds were predominantly situated in the right temple area, followed by the precordial area in suicidal deaths and by the chest area in homicidal deaths.

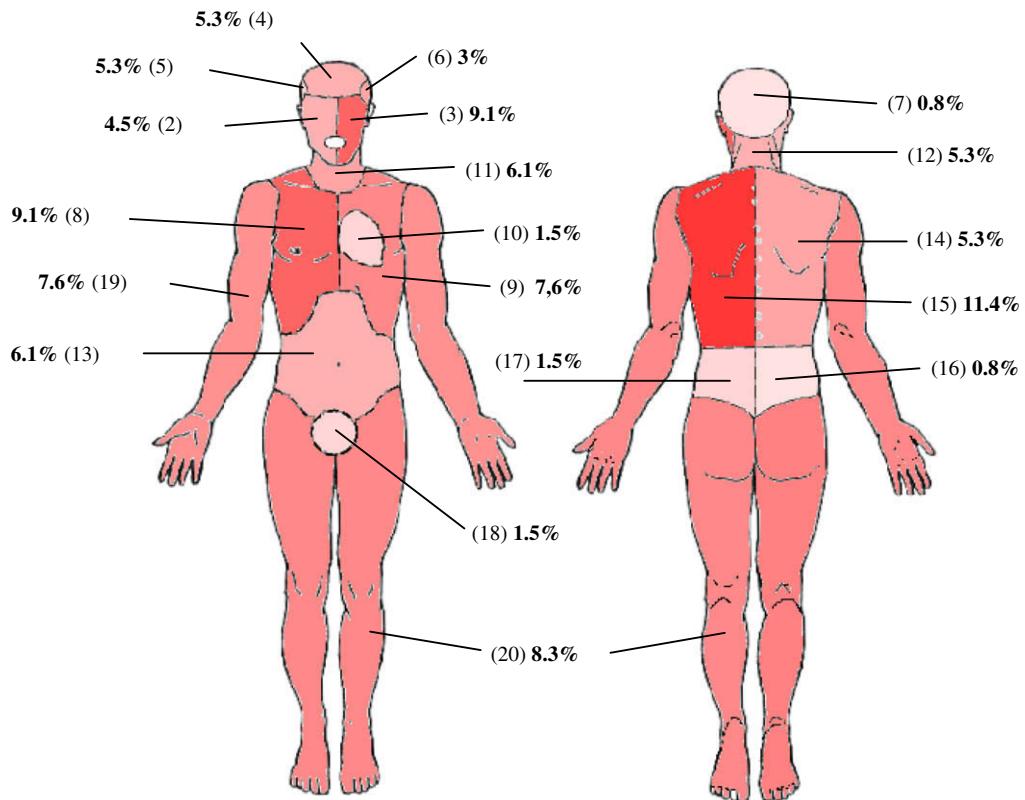


Fig. 2. Homicides: distribution of entry wounds (for details, see Fig. 1).

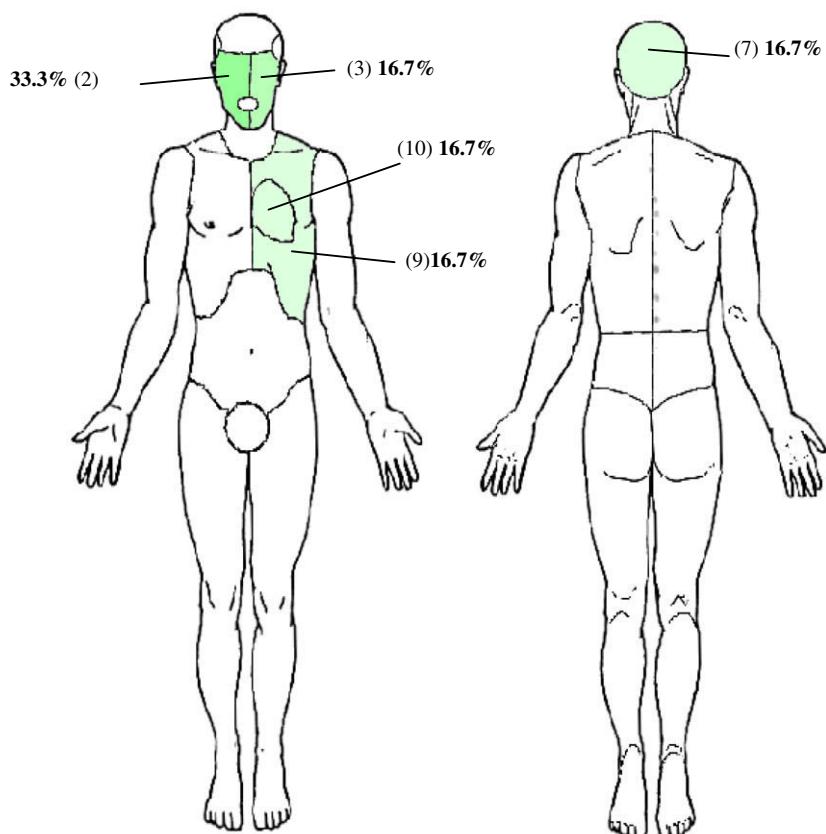


Fig. 3. Accidental deaths: distribution of entry wounds (for details, see Fig. 1).

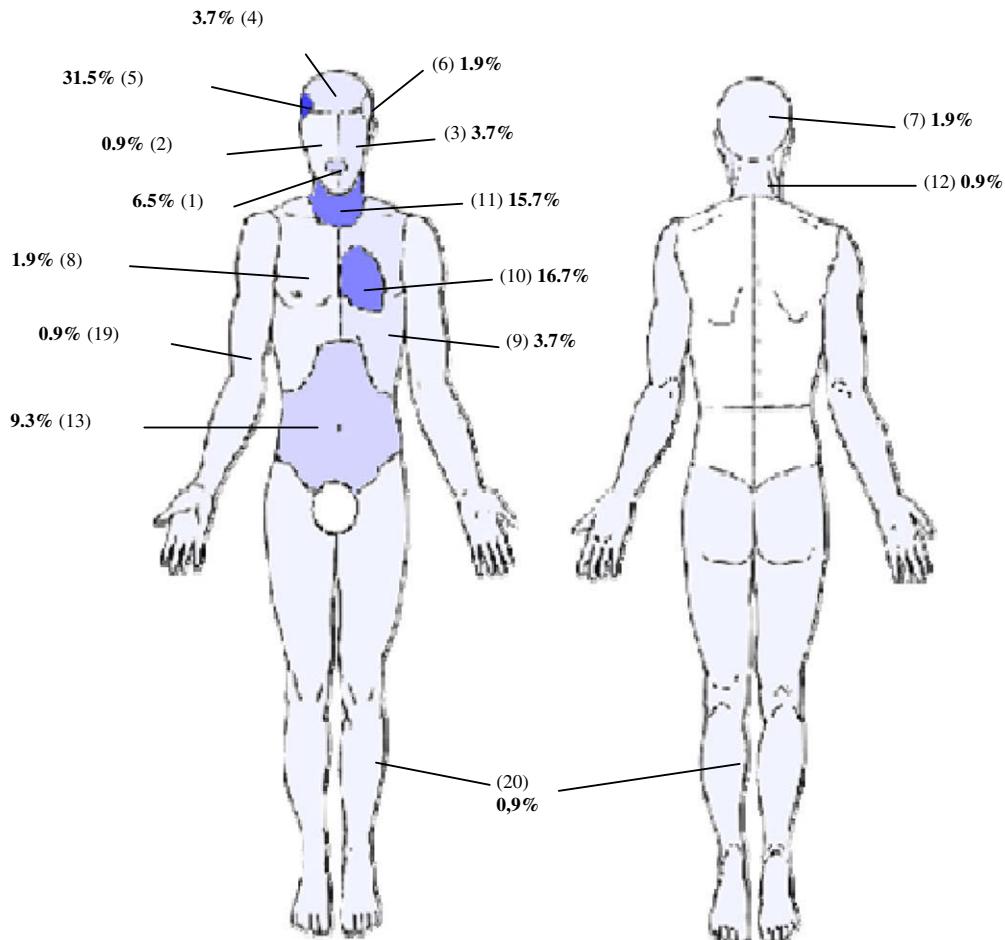


Fig. 4. Suicides: distribution of entry wounds (for details, see Fig. 1).

Table 3
Laboratory findings (M: male; F: female).

	Homicides		Suicides		Total	
	M	F	M	F		
Negative	15	(55.6%)	2	(8.7%)	21	(52.5%)
Positive	6	(26.1%)	2	(8.7%)	14	(35.0%)
Alcohol	3	(13.0%)	1	(4.3%)	11	(27.5%)
Cocaine	1	(4.3%)	–	–	2	(5.0%)
Alcohol + Cocaine	1	(4.3%)	–	–	–	–
Alcohol + Cocaine + Cannabis	–	–	–	–	1	(2.5%)
Cocaine + Cannabis	–	–	1	(4.3%)	–	–
Alcohol + MDMA	1	(4.3%)	–	–	–	–

Table 4
A cross-study comparison between the 1994–2006 and 1983–1993 periods in Brescia County, Italy.

	Brescia 1994–2006	Brescia 1983–1993
No. of firearm victims ^a	2.8%	2.5%
Homicides	35.9%	50%
Suicides	60.4%	41.7%
Accidentals	3.7%	8.3%
Victim's gender	86% males – 14% females	87.6% males – 12.4% females
Most prevalent age range (homicides)	21–30 years	21–30 years
Most prevalent age range (suicides)	No prevalent age ranges identified	41–50 years
Type of weapon	Single-action weapon (68.3%)	Single-action weapon (68.7%)
Most common entry wound site (suicides)	Right temple	Right temple

^a % of the total number of post-mortem examinations.

Table 5

Comparison between Brescia and other Italian urban counties.

	Brescia (Northern Italy)	Udine (Northern Italy) ¹⁸	Genoa (North-eastern Italy) ¹⁹	Rome (Central Italy) ²⁰	Bari (Southern Italy) ¹⁵
No. of firearm-related casualties ^a	2.8%	/	1.6%	3.04%	27.7%
Most prevalent manner of death	Suicide	Homicide	Suicide	Suicide	Homicide
Most prevalent victim's gender	Males	Males	Males	Males	Males
Most prevalent victim's age	21–30 years	31–40 years	31–40 years	31–40 years	21–30 years
Most common site of entry (suicides)	Right temple (31.5%)	Head (85%)	Head (46.5%)	Right temple (50%)	Right temple (46.5%)
Toxicological findings	Alcohol and/or cocaine	/	/	Alcohol and/or cocaine	/

^a % of the total number of the post-mortem examinations.

4.2. Brescia and the Italian context

The results produced by the present study were compared to those obtained by comparable ones conducted in other Italian urban counties such as Udine (Northern Italy),¹⁸ Genoa (North-eastern Italy),¹⁹ Rome (Central Italy)²⁰ and Bari (Southern Italy)¹⁵ (Table 5).

The overall incidence of firearm-related deaths as recorded by the present study, 2.8%, is very similar to the one reported by the Genoa Institute of Forensic Medicine (1.6% in the years between 1991–2000) and by the Rome Institute of Forensic Medicine (3.04% in the years between 1990–2000), though much different than the one reported by the Bari Institute of Forensic Medicine over the 1988-to-2003 period (27.7% of all post-mortem examinations).

As for the manners of death, suicidal conduct proved to be the main cause of firearm-related casualties in Brescia, Genoa and Rome, while homicides predominated in the urban counties of Udine and Bari.

In all of the studies at hand, most casualties were male regardless of the manner of their death.

Most homicide victims accounted for by the studies conducted in Udine, Genoa and Rome fell within the 31-to-40 year age range, followed by the sixth and the fourth age decades, while in Brescia and in Bari the most predominant age group was the 21-to-30 year one, followed by the sixth and the fourth age decades.

Interestingly, female homicide victimization rates saw a peak in the 21–40 year age group in all studies at hand.

As for suicides, the data emerging from this study highlighted a notable predominance in the winter months, as did the studies conducted in Bari and Rome.

Still according to all Italian studies at hand, short-barrelled, single-action weapons (essentially, guns and revolvers) seem to have been the firearms of choice both in cases of homicide and suicide.

In cases of suicide, most entry wounds were situated on the head (Brescia 48.2%; Genoa 46.5%; Udine 85%; Rome 66%), the right temple being the area of most frequent involvement (Brescia 31.5%; Rome 50%; Bari 46.5%).

Finally, as previously highlighted in the study conducted in Rome, most corpses showing positive results for any of the toxicological screenings mentioned above presented traces or metabolites of alcohol, cocaine, or a combination of both, and happened to be males and aged between 21 and 50.

4.3. Brescia and the international context

When comparing the results of this study with those emerging from comparable studies conducted in other countries, the necessity becomes apparent of carefully taking into account all cultural and regulatory aspects of the different national contexts at issue.

In fact, the frequency of firearm-related deaths appears to be higher in nations where firearms are more readily available, either legally or illegally: in South Africa, for instance,²¹ firearm-related

casualties are sensibly more significant than in many other African countries the likes of Cameroon, where a strict regulatory approach seems to have been successful at curbing acts of violence involving the use of guns.²²

In countries such as the USA,^{2–4,6–9} whose Second Constitutional Amendment clearly establishes an individual's right to self defence, firearms are more affordable and more easily accessible, which notably influences the number of gunshot victims reported in that Country on a yearly basis (10/100.000 inhabitants,⁶ far from the 0.84/100.000 rate emerging from the present study).

As for Europe, the available data do not differ much from the ones obtained in Italy: in Finland,²³ for example, the frequency of gunshot casualties over the 1995–2001 period amounted to 2.16% of all violent deaths, an outcome very close to the 2.8% rate emerging from this study.

In the Middle East, the frequency of firearm-related casualties may vary greatly from country to country, sometimes even from region to region within a single country, as in the case of Turkey.^{24,25}

In the USA,^{26–28} accidental deaths are all but unusual, especially among children, whereas in Sweden²⁹ and Germany³⁰ most accidental firearm-related casualties fell within the adult age group, and mainly occurred as a consequence of hunting and military drill accidents or as a consequence of unsafe gun-handling practices.

In terms of overall recurrences, all of the studies at hand seem to share the commonalities of male gender, of young adult involvement, and of the use of single-action, short-barrelled guns (guns, revolvers, etc.).

From an anatomical point of view, and in cases of suicide, all studies examined consistently report entry wounds as mainly situated on the temple, followed by the chest (precordium), and by the abdomen.

5. Conclusions

According to numerous studies,^{1–6} a correlation exists between the presence of factors such as social disenfranchisement, poverty, crime, and drug use on the one hand and access to firearms on the other.

In light of these considerations, Brescia County's current situation may still present a wide margin for improvement both in terms of law enforcement and prosecutorial approaches to firearm possession and firearm-related incidents and in terms of proper mental health and background checking practices aimed at those either applying for a deadly weapon license or holding one already.

Conflict of Interest

None declared.

Funding

None declared.

Ethical Approval

None declared.

References

- Rawson B. Aiming for prevention: medical and public health approaches to small arms, gun violence, and injury. *Croat Med J* 2002;4:379–85.
- Miller M, Azrael D, Hemenway D. Rates of household firearm ownership and homicide across US regions and states, 1988–1997. *Am J Public Health* 2002;12:1988–93.
- Kaplan MS, Geling O. Firearm suicides and homicides in the United States: regional variations and patterns of gun ownership. *Soc Sci Med* 1998;9:1227–33.
- Streib EW, Hackworth J, Hayward TZ, et al. Firearm suicide: use of a firearm injury and death surveillance system. *J Trauma* 2007;3:730–4.
- Bridges FS, Kunselman JC. Gun availability and use of guns for suicide, homicide, and murder in Canada. *Percept Mot Skills* 2004;2:594–8.
- Christoffel KK. Firearm injuries: epidemic then, endemic now. *Am J Public Health* 2007;4:626–9.
- Firearm-related deaths – Louisiana and Texas, 1970–1990. . *MMWR* 1992;41:213–5.
- Krug EG, Powell KE, Dahlberg LL. Firearm-related deaths in the United States and 35 other high- and upper-middle-income countries. *Int J Epidemiol* 1998;2:214–21.
- Miller M, Azrael D, Hemenway D. The epidemiology of case fatality rates for suicide in the Northeast. *Ann Emerg Med* 2004;6:723–30.
- Karlsson T, Isaksson B, Ormstad K. Gunshot fatalities in Stockholm, Sweden with special reference to the use of illegal weapons. *J Forensic Sci* 1993;6:1409–21.
- Mattila VM, Makitie I, Pihlajamaki H. Trends in hospitalization for firearm-related injury in Finland from 1990 to 2003. *J Trauma* 2006;5:1222–7.
- Thomsen JL, Albrektsen SB. An investigation of the pattern of firearms fatalities before and after the introduction of new legislation in Denmark. *Med Sci Law* 1991;2:162–6.
- Chapman J, Milroy CM. Firearm deaths in Yorkshire and Humberside. *Forensic Sci Int* 1992;2:181–91.
- Rouse D, Dunn L. Firearm fatalities. *Forensic Sci Int* 1992;1:59–64.
- Solarino B, Nicoletti EM, Di Vella G. Fatal firearm wounds: a retrospective study in Bari (Italy) between 1988 and 2003. *Forensic Sci Int* 2007;2–3:95–101.
- <<http://www.istat.it>>.
- Birbes MG, Zambelli L. Lesività da arma da fuoco: casistica del settore medico-legale bresciano (1983–1993). *Arch Med Leg Ass* 1995;17:49–62.
- Desinan L, Mazzolo GM. Gunshot fatalities: suicide, homicide or accident? A series of 48 cases. *Forensic Sci Int* 2005;147S:37–40.
- Ventura F, Angi A, Braidotti A, et al. L'omicidio d'arma da fuoco nel settore medico-legale genovese nel decennio 1991–2000. *Zacchia* 2001;74(Suppl.):215–31.
- Cicciarello E, Umani Ronchi F, Bolino G. Casistica del settore medico-legale romano in tema di lesività da armi da fuoco (anni 1990–2000). *Zacchia* 2001;74(Suppl.):247–80.
- Meel B. Trends in firearm-related deaths in the Transkei region of South Africa. *Am J Forensic Med Pathol* 2007;1:86–90.
- Bahebeck J, Atangana R, Mboudou E, et al. Incidence, case-fatality rate and clinical pattern of firearm injuries in two cities where arm owing is forbidden. *Injury* 2005;6:714–7.
- Rainio J, Sajantila A. Fatal gunshot wounds between 1995 and 2001 in a highly populated region in Finland. *Am J Forensic Med Pathol* 2005;1:70–7.
- Fedakar R, Gundogmus UN, Turkmen N. Firearm-related deaths in two industrial cities of Turkey and their province. *Leg Med* 2007;1:14–21.
- Goren S, Subasi M, Tirasci Y, et al. Firearm-related mortality: a review of four hundred-forty four deaths in Diyarbakir, Turkey between 1996 and 2001. *Tohoku J Exp Med* 2003;3:139–45.
- Miller M, Azrael D, Hemenway D, et al. Firearm storage practices and rates of unintentional firearm deaths in the United States. *Accid Anal Prev* 2005;4:661–7.
- Hepburn L, Azrael D, Miller M, et al. The effect of child access prevention laws on unintentional child firearm fatalities, 1979–2000. *J Trauma* 2006;2:423–8.
- Grossman DC, Mueller BA, Riedy C, et al. Gun storage practices and risk of youth suicide and unintentional firearm injuries. *JAMA* 2005;6:707–14.
- Örnrehult L, Eriksson A. Fatal firearm accidents in Sweden. *Forensic Sci Int* 1987;4:257–66.
- Karger B, Wissmann F, Gerlach D, et al. Firearm fatalities and injuries from hunting accidents in Germany. *Int J Legal Med* 1996;5:252–5.